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## Published

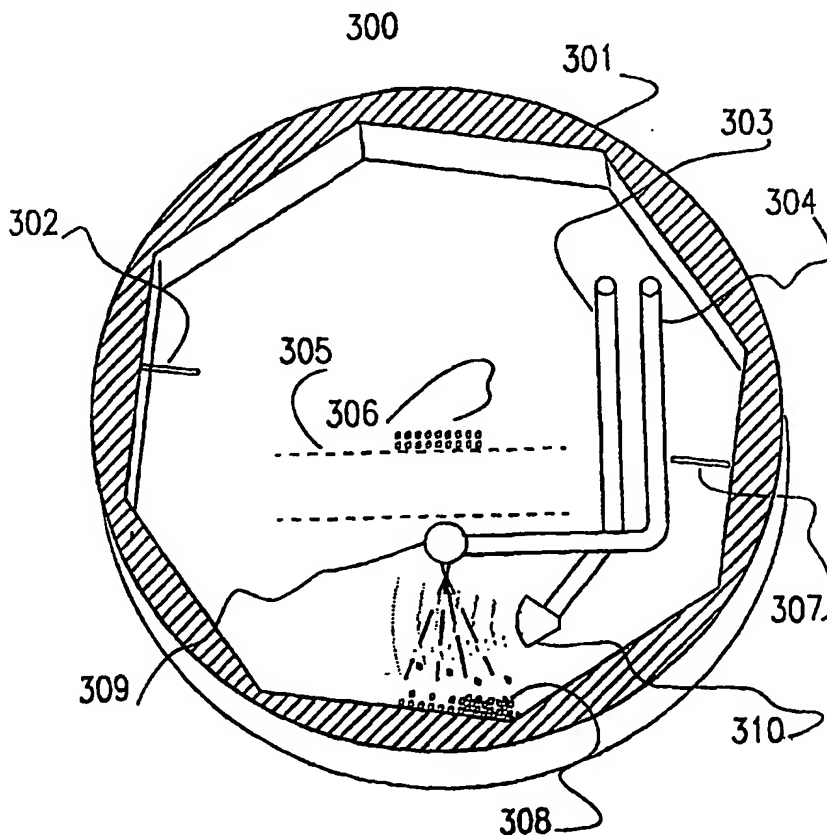
With international search report.

Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: FROZEN FOOD PRODUCT WITH A COATING OF ICE ON THE EXTERIOR AND PROCESS

## (57) Abstract

A method of preparing a particulate frozen food product, especially frozen cheese granules or shreds, in which moisture is added to the particulate food product prior to or at the time of freezing, or following freezing, so that some or all of the food particles have a coating of ice on the exterior. The method has particular application to the preparation of frozen grated mozzarella cheese for use in cooking of food products such as pizzas. A frozen food product consists of particles each having a core of mozzarella cheese coated with ice. Cheese particles are transferred via conveyor (305) into a chilled rotating drum and is sprayed with liquid nitrogen from nozzle (309) and the chilled cheese is then exposed to a fine water spray from nozzle (310) so that the cheese particles are coated with ice before they impact the rotating tumbler (301) which has an octagonal interior and two boards (302, 307) which help to ensure that the tumbling product is mixed.



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FROZEN FOOD PRODUCT WITH A COATING OF ICE ON THE EXTERIOR AND PROCESS

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## FIELD

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This invention relates to frozen food products, especially food products which are comminuted and frozen. The examples relate to the preparation of frozen cheese granules or shreds. It has particular application to the preparation of frozen grated mozzarella cheese for use in cooking of food products such as pizzas. The invention also has application to a method of producing pizzas using cheese processed in this way.

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## BACKGROUND

Pizzas have been traditionally made with fresh grated mozzarella cheese. Such cheese usually has a high moisture content.

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Attempts have been made to grate and freeze mozzarella cheese, but this has not proved to be satisfactory, when the cheese is used in the cooking of pizzas. The freezing process may cause the cheese to dry out, resulting in an imperfect product, and one which is prone to blistering, burning, and may result in a loss of colour if the resulting pizza is kept warm for a period of time between cooking and delivery to the customer.

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One of the problems in grating cheese, especially a curd cheese such as mozzarella cheese, is that the moisture content of cheese produced in the dairy factory may vary considerably, with a high moisture content being more suitable for some cooking processes, but on the other hand the higher the moisture content the softer the cheese and the more difficult it is to grate or shred. An additional problem is that some food products require cheese to have a particular moisture content for certain cooking

- 2 -

processes, and this is difficult to achieve in the dairy factory as the moisture level may vary by 5% from the desired product specification.

5     **OBJECT**

It is an object of this invention to provide an improved process for producing or using frozen food products, especially frozen cheese, or one which will at least provide the public with a useful choice.

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**STATEMENT OF INVENTION**

In one aspect, the invention provides a method of preparing a particulate frozen food product, in which

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moisture is added to the particulate food product prior to, or at the time of freezing, or following freezing, so that some or all of the food particles have a coating of ice on their exterior.

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In another aspect, the invention provides a method of preparing frozen cheese particles, wherein moisture is added to the cheese particles prior to, or at the time of freezing of the cheese, or following freezing of the cheese, so that the product has a layer of ice associated with a majority of the cheese particles.

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Preferably the cheese is comminuted prior to freezing to produce cheese granules or shreds.

In the most preferred form of the invention, the cheese is comminuted to produce small generally spherical granules.

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In another aspect, the invention provides a method of producing a cheese product in which the cheese is grated or shredded, and is then rapidly frozen, wherein the grated or shredded cheese is supplied to a tumbler and moisture is sprayed onto the cheese granules or shreds during the freezing process.

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Preferably the freezing of the cheese granules or shreds takes place in the tumbler, by use of a cold fluid such as a liquified air/gas or blast of cold air or gas applied to the

- 3 -

interior of the tumbler.

5 Preferably the moisture is applied by means of a spray nozzle spraying moisture onto the cheese in conjunction with the application of a liquified gas, so that the moisture droplets are caused to substantially freeze, before they contact the cheese.

Preferably the liquified gas is liquid nitrogen or liquid carbon dioxide.

10 Preferably the cheese is a curd cheese such as mozzarella cheese.

Preferably the initial water content of the cheese is chosen during manufacture to make the cheese amenable to comminution.

15 Preferably the tumbler is in the form of a hollow cylindrical or a prismatic shape optionally having a series of flats or flights on the inside thereof, capable of causing the cheese granules or shreds to be tumbled and separated during the passage through the tumbler. Preferably the tumbler is in the form of a tunnel, on a slight incline, so that the passage through the tumbler will be controlled by the rate of rotation of the tumbler,  
20 and the incline of the tumbler.

In another aspect, the invention finds a method of controlling the moisture content of a food product, in which the food product is stored as a frozen product together with additional moisture, so that when the product is thawed the additional moisture is  
25 absorbed into the food to increase its moisture content prior to cooking.

In another aspect, the invention provides a method of preparing food using a particulate frozen food product, in which some or all of the food particles have a coating of ice on their exterior, and the frozen food particles are defrosted in a container or receptacle  
30 over a sufficient period of time that the ice melts and some or all of the resulting moisture is absorbed by the food particles.

Preferably the frozen food product consists of granule of cheese coated with a layer or layers of ice. More preferably the cheese is a mozzarella cheese and granules and the  
35 total ice content is between 1% and 5% of the total weight of cheese prior to freezing.

In the preferred form of the invention substantially all of the particles each has an ice layer of between 1.5% and 2% of the weight of its respective granule prior to freezing.

- 5 In another aspect, the invention provides a method of preparing a cooked cheese product such as a pizza, in which frozen cheese granules having a coating of ice on their exterior are defrosted in a container or receptacle over a sufficient period of time that the ice melts and some or all of the resulting moisture is absorbed by the cheese particles, and the cheese particles are applied to the food which is then cooked.

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## DRAWINGS

- These and other aspects of this invention, which will be considered in all its novel aspects, will become apparent from the following description, which is given by way of example only, with reference to the accompanying drawings, in which:

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Fig 1: is an illustration of a tumbler of the present invention in side view.

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Fig 2: is an illustration of the mixing and freezing section of the present invention, in side view.

Fig 3: is an illustration of the mixing and freezing section of the present invention, in end view and within the tumbler.

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Fig 4: is an illustration of the delivery end of the tumbler of the present invention.

## PREFERRED EMBODIMENT

### Example 1

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The overall principle of the production of the frozen food product of this invention is one of rapidly freezing the cheese in grated or other particulate form along with a metered quantity of water and forming a type of coated granule in which the core is mozzarella cheese and the coating is ice, in a substantially even mixture.

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- 5 -

Referring to Figures 1 to 4, the freshly comminuted; i.e. diced, grated, shredded or otherwise broken down cheese is placed in a hopper 101 and caused to drop at an even rate onto a conveyer belt 102, 204, 305 which carries it into a freezing apparatus.

5 Preferably the hopper is inside a temperature-controlled room as well as the remainder of the apparatus, and preferably the room is held at below zero degrees C.

A preferred feed rate for a working embodiment is 36 Kg per minute of grated mozzarella cheese.

10

The supply of cheese 203, 306 falls off the end of the conveyer belt inside a slowly rotating, slightly sloping (at about 3 degrees) tumbler 107, 301 which may have a cylindrical exterior for the purpose of rolling it on roller bearings against 105, 106 but which preferably has an octagonal interior outline as shown in Fig 3. This aids in the  
15 mixing process, and two boards 302, 307 help to ensure that the tumbling product is mixed.

Preferred dimensions of an example tumbler are 1.5 metres diameter, 6 metres length, and a rotation speed of 28-30 revolutions per minute,

20

As the cheese falls off the conveyer it falls into a freezing apparatus, past an array of nozzles 205, 309 squirting a coolant such as liquid nitrogen at a substantially controlled rate in a substantially downwards direction. Thus the cheese (at 207) is exposed to an effective chilling medium delivered in either a liquid or in a vaporised form. The  
25 dimensions of the tumbler are such that only the outermost skin of the cheese is likely to become frozen before its fall is arrested by contacting the internal wall of the tumbler 208. However freezing continues for some time. In addition to a spray of liquid nitrogen, the freezing apparatus within the tumbler is provided with means 206, 310 to provide a spray of water, substantially transversely across the spray of liquid nitrogen.  
30 Both the water and the coolant are introduced by means of pipes 103 & 104, 201 & 202, 303 & 304.

A preferred feed rate for the prototype embodiment is 0.5 to 5 litres per minute of water at tap temperature, and 1.5 litres per minute of liquid nitrogen, at -178 degrees C.

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- 6 -

5 The water is rapidly converted into a shower of ice particles and it is desirable that it is substantially frozen prior to making contact with the wall of the tumbler, because otherwise ice builds up on the interior surface if the water freezes after contact. At least some of the water forms a coating of ice on the cheese, for all three of the water, the coolant, and the cheese particles are falling through the cooling zone within the tumbler at the same time.

10 The remainder of the now-frozen water and the initially coated cheese particles 209, 308 are tumbled together within the tumbler as they gradually make their way under the influence of gravity towards the outlet end of the tumbler. The cheese particles pick up a further coating of ice as they travel, so that on emergence substantially all of the ice is collected around cheese particles which are now in the form of ice-coated granules of cheese.

15 Ultimately the coated cheese granules emerge from the tumbler through orifices 402, 403 at the lower end of the tumbler and fall onto another conveyer belt 109 in heaps 108 and are subsequently packed and distributed; all such operations preferably occurring in sub-zero temperatures.

20 Prior to use, the frozen granular mozzarella cheese is preferably allowed to defrost for about 24 hours. During that period much of the melted water is absorbed by the cheese, thus raising its water content to a level suitable for use in applications such as the preparation of ready-to-eat pizzas.

25 Process control aspects include:  
Preferably, measurement of the water content of the cheese fed into the tumbler is carried out so that the proportion of added water may be adjusted to compensate for variability on the part of the cheese factory. (Constancy of water content to better than 30 8-9% is difficult to realise.)

35 Preferably, the proportion of liquid nitrogen or other coolant may be varied (as a result of varying the feed rate of the cheese and/or the supply rate of water) so that the coating effect wherein ice is applied over the cheese granules is retained. Too little coolant may delay freezing until after the water has contacted the tumbler sides, and too much coolant may render the ice too "dry" so that it has little or no cohesion during tumbling.



- 7 -

Alternatives to the above preferred embodiment, which is given by way of example, include:

- 5 Variations to the size of the tumbler, to its internal geometry, its slope, and to its rotation rate

Other foods that may be frozen in this way include other cheeses, other dairy products, or small fruits and the like,

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Alternative coolants apart from liquid nitrogen include liquid air, liquid oxygen, gaseous, liquid, or solid carbon dioxide, or a flow of cold air at some pressure.

#### **Other Food Products**

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The method and apparatus of Example 1 has been tested with other food products and without limiting the generality of the method of preparing a particulate frozen food product, it has been found to be suitable for products chosen from the group comprising Cheddar Cheese, Colby Cheese, Egmont Cheese, Edam Cheese, Gouda Cheese, diced  
20 vegetables, shredded vegetables, diced butter, and shredded butter.

#### **Example 2**

Preparation of a pizza using the frozen cheese product of this invention.

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In general a pizza comprises a substrate or base of dough, covered with a topping including materials selected from the range of tomatoes, peppers, cheese, onions, meats, fish, shellfish, crustaceans, and the like. There is a great variety of recipes. A cheese is preferred in the majority of recipes, and mozzarella cheese is well known to be  
30 particularly suitable for the purpose because both its physical properties (it melts and acts as a matrix for other components) and for its gastronomic attributes.

The frozen cheese product of this invention allows the preparation of an improved pizza, especially at sites where fresh mozzarella cheese is not available. The frozen  
35 mozzarella preparation of this invention may be stored for an extended period, and optionally transported, in its frozen state.

- 8 -

Accordingly, the preparation of a pizza which includes the mozzarella (or other curd cheese) of this invention comprises an additional step superimposed on the usual steps involved in the cooking of a pizza.

5

Prior to blending with other ingredients used in the topping of a pizza, the frozen cheese of this invention is preferably allowed to defrost for about 24 hours. (This is not a limiting figure). One guide as to when the process is complete is to assess the amount of free water remaining in the container. The frozen granular mozzarella cheese may be placed in a covered or an uncovered container, but for food hygiene reasons the container is preferably closed. During the defrosting period much of the melted water surrounding each granule or particle of cheese is absorbed by the cheese, thus raising its water content to a preferred level suitable for use in applications such as the preparation of ready-to-eat pizzas.

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It should be noted that the preferred water content for grating mozzarella cheese is lower than the preferred water content for cooking within pizza toppings, and therefore the invention has the advantage of providing an improved water content at both the comminution stage and also the cooking stage of the process of preparing cheese for eventual use in the preparation of a pizza.

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Finally, it will be appreciated that various alterations and modifications may be made to the foregoing without departing from the scope of this invention as set forth.

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**CLAIMS**

- 5        1.     A method of preparing a particulate frozen food product, in which moisture is added to the particulate food product prior to, or at the time of freezing, or following freezing, so that some or all of the food particles have a coating of ice on their exterior.
- 10      2.     A method of preparing a particulate frozen food product, as claimed in claim 1 wherein the particulate food product is chosen from the group comprising Cheddar Cheese, Colby Cheese, Egmont Cheese, Edam Cheese, Gouda Cheese, diced vegetables, shredded vegetables, diced butter, and shredded butter.
- 15      3.     A method of preparing frozen cheese particles, wherein moisture is added to the cheese particles prior to, or at the time of freezing of the cheese, or following freezing of the cheese, so that the product has a layer of ice associated with a majority of the cheese particles.
- 20      4.     A method of preparing frozen cheese particles as claimed in claim 3, wherein the cheese is comminuted prior to freezing to produce cheese granules or shreds.
- 25      5.     A method of preparing frozen cheese particles as claimed in claim 3, wherein the cheese is comminuted prior to freezing to produce small generally spherical granules.
- 30      6.     A method of producing a cheese product in which the cheese is grated or shredded, and is then rapidly frozen, wherein the grated or shredded cheese is supplied to a tumbler and moisture is sprayed onto the cheese granules or shreds during the freezing process.
- 35      7.     A method of preparing frozen cheese particles as claimed in claim 6, wherein the freezing of the cheese granules or shreds takes place in the tumbler, by use of a cold fluid such as a liquified air/gas or blast of cold air or gas applied to the interior of the tumbler.

- 10 -

- 5 8. A method of preparing frozen cheese particles as claimed in claim 7, wherein the moisture is applied by means of a spray nozzle spraying moisture onto the cheese in conjunction with the application of a liquified gas, so that the moisture droplets are caused to substantially freeze, before they contact the cheese.
9. A method of preparing frozen cheese particles as claimed in claim 8, wherein the liquified gas is liquid nitrogen or liquid carbon dioxide.
- 10 10. A method of preparing frozen cheese particles as claimed in claim 9, wherein the cheese is a curd cheese such as mozzarella cheese.
11. A method of preparing frozen cheese particles as claimed in claim 10, wherein the initial water content of the cheese is chosen during manufacture to make the cheese amenable to comminution.
- 15 12. A method of preparing frozen cheese particles as claimed in claim 11, wherein the tumbler is in the form of a hollow cylindrical or a prismatic shape optionally having a series of flats or flights on the inside thereof, capable of causing the cheese granules or shreds to be tumbled and separated during the passage through the tumbler.
- 20 13. A method of preparing frozen cheese particles as claimed in claim 12, wherein the tumbler is in the form of a tunnel, on a slight incline, so that the passage through the tumbler will be controlled by the rate of rotation of the tumbler, and the incline of the tumbler.
- 25 14. A method of controlling the moisture content of a food product, in which the food product is stored as a frozen product together with additional moisture, so that when the product is thawed the additional moisture is absorbed into the food to increase its moisture content prior to cooking.
- 30 15. A method of preparing food using a particulate frozen food product, in which some or all of the food particles have a coating of ice on their exterior, and the frozen food particles are defrosted in a container or receptacle over a sufficient period of time that the ice melts and some or all of the resulting moisture is
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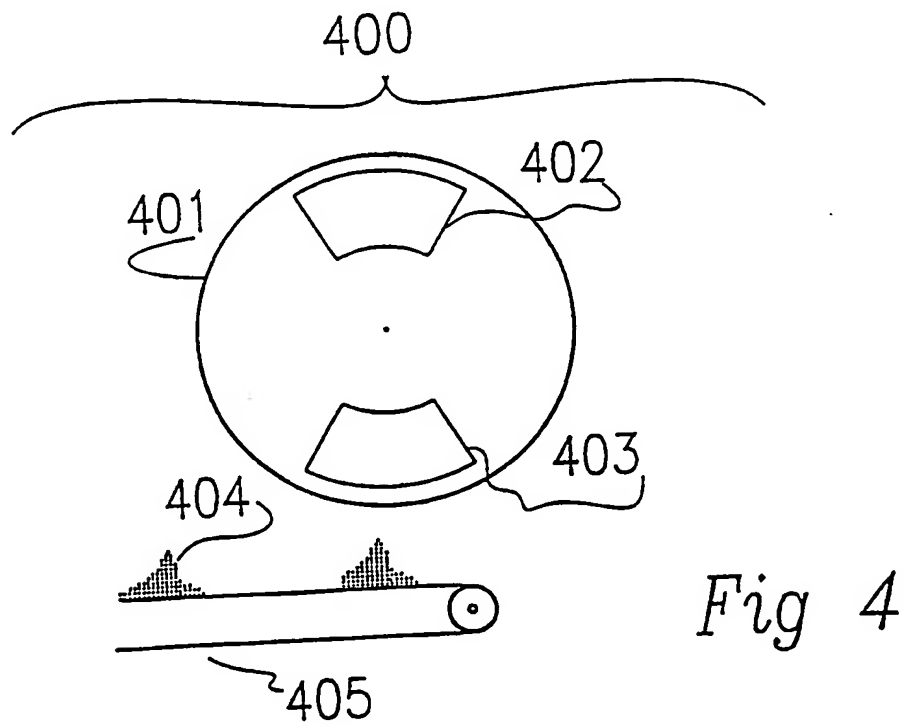
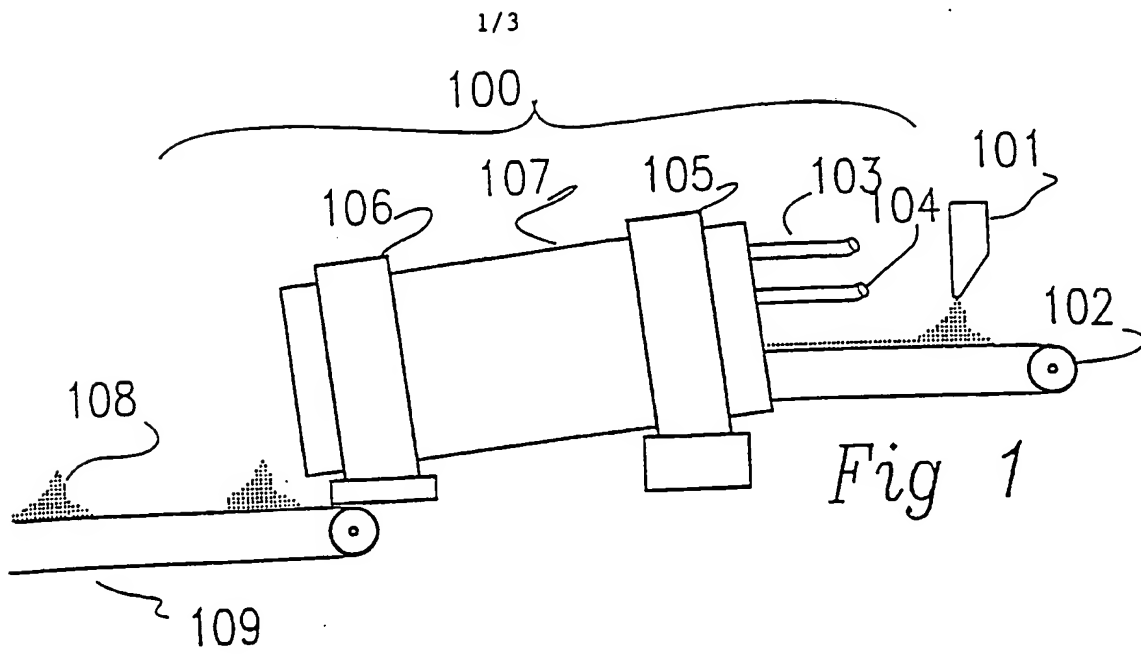
absorbed by the food particles.

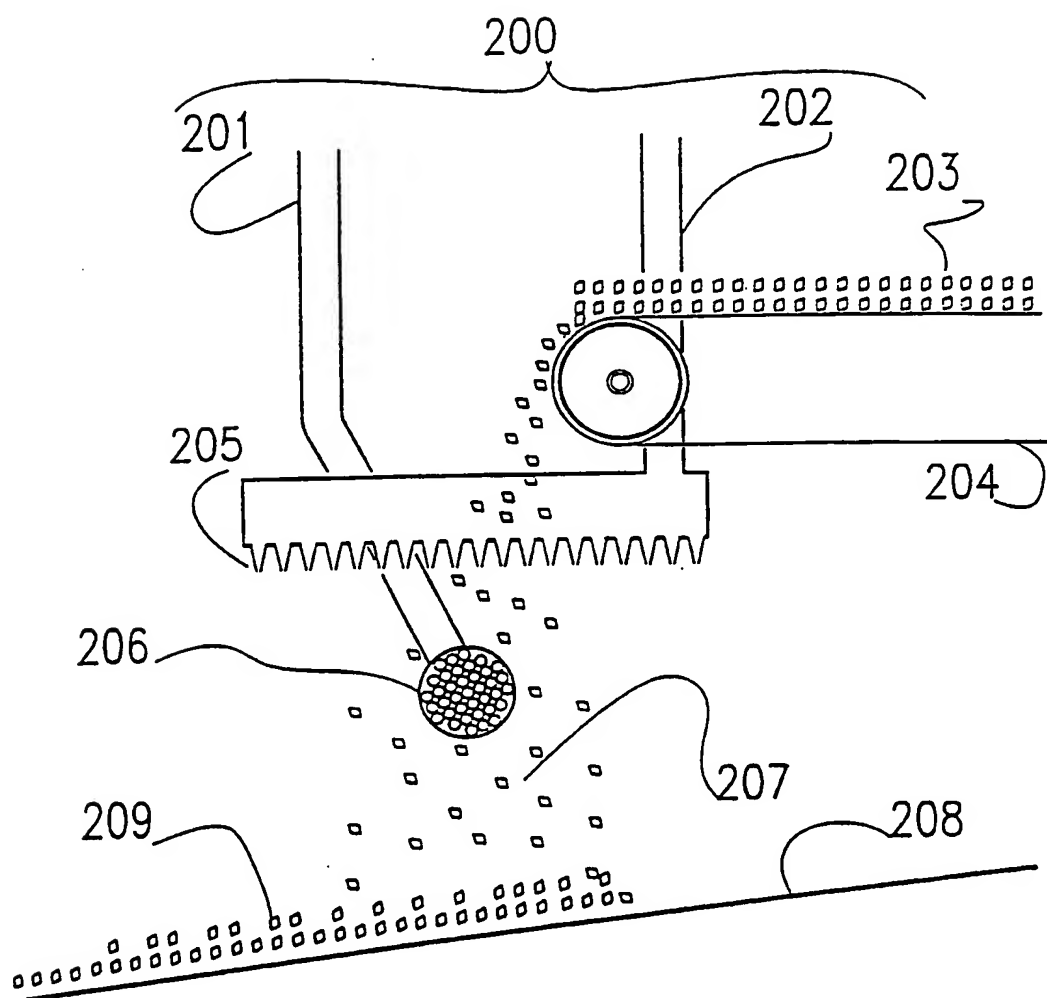
- 5 16. A method of preparing frozen cheese particles as claimed in claim 15, wherein the frozen food product consists of granule of cheese coated with a layer or layers of ice.
- 10 17. A method of preparing frozen cheese particles as claimed in claim 16, wherein the cheese is a mozzarella cheese and granules and the total ice content is between 1% and 5% of the total weight of cheese prior to freezing.
- 15 18. A method of preparing frozen cheese particles as claimed in claim 17, wherein substantially all of the particles each has an ice layer of between 1.5% and 2% of the weight of its respective granule prior to freezing.
- 20 19. A method of preparing a cooked cheese product such as a pizza, in which frozen cheese granules having a coating of ice on their exterior are defrosted in a container or receptacle over a sufficient period of time that the ice melts and some or all of the resulting moisture is absorbed by the cheese particles, and the cheese particles are applied to the food which is then cooked.

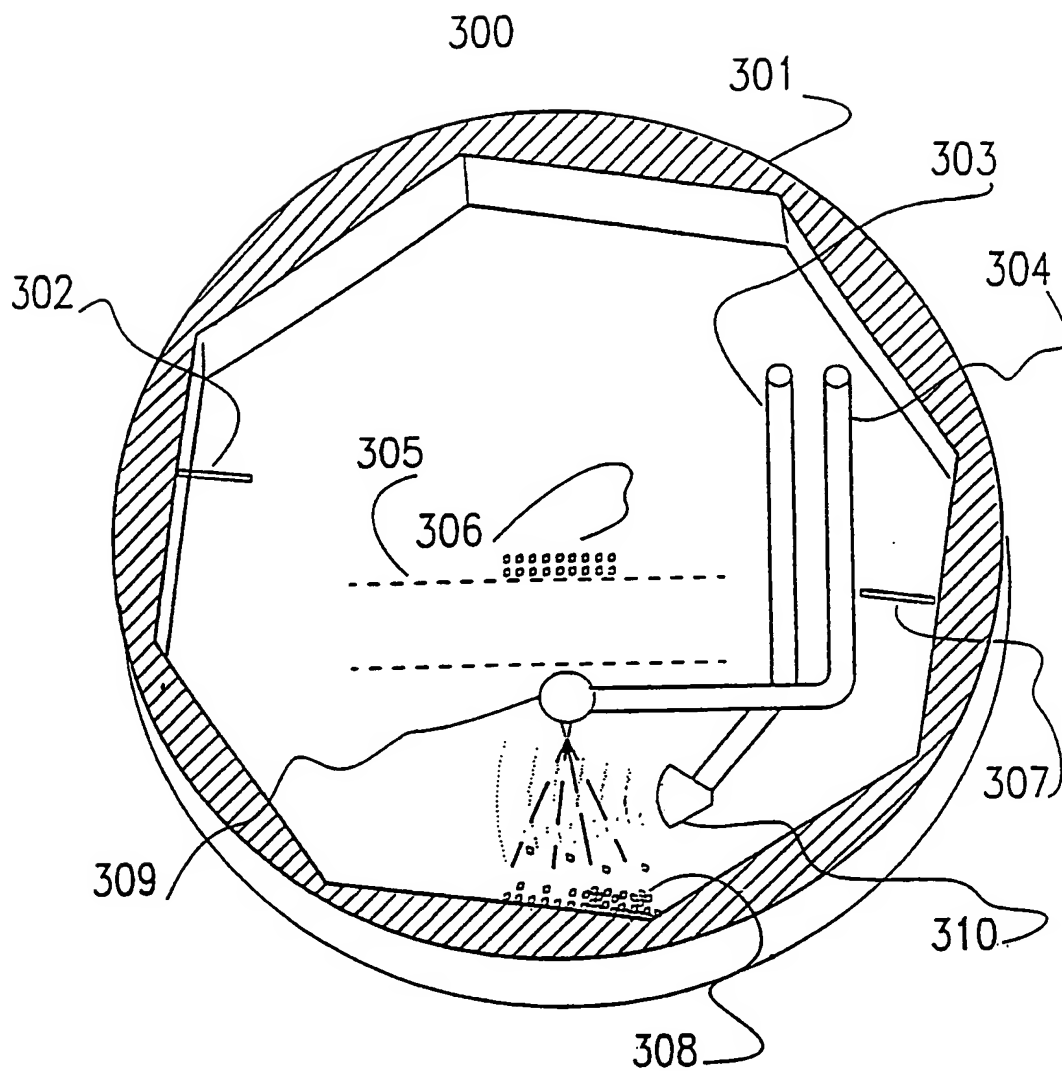
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*Fig 2*

*Fig 3*



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/NZ/95/00007

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> Int. Cl. <sup>6</sup> A23C 019/16; A23P 001/08  According to International Patent Classification (IPC) or to both national classification and IPC					
<b>B. FIELDS SEARCHED</b>  Minimum documentation searched (classification system followed by classification symbols) A23C 019/16; A23P 001/08; A23G 009/24; A23C 019/097; A23G 009/00; A23G 009/02  Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched AU: IPC as above  Electronic data base consulted during the international search (name of data base, and where practicable, search terms used) DERWENT: A23P 1/08 & A23C 19/09 - (WATER OR ICE OR H2O OR MOISTURE) AND (FREEZ: OR FROZEN) CHEM AB AND (COAT: OR COVER:) A23G 9/00 & A23G 9/02 - COAT: OR COVER					
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>					
<b>Category*</b>	<b>Citation of document, with indication, where appropriate, of the relevant passages</b>	<b>Relevant to Claim No.</b>			
X	Derwent Abstract Accession No. 83-767571/38, Class D13, JP, A, 58-134979 (SUGAR LADY KK) 11 August 1983 (11.08.83) See abstract	1-19			
X	Chemical Abstracts, Vol. 88, No. 7, issued February 13, 1978 (13.02.78) Columbus, Ohio, USA, Ohhashi, Shiro; Kochi, Takashi; Okuno, Kaoru, "Ice coating for frozen foods", page 419, column 2, abstract no. 49260r. See abstract	1-19			
<div style="display: flex; justify-content: space-between;"> <span><input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.</span> <span><input checked="" type="checkbox"/> See patent family annex.</span> </div>					
<table style="width: 100%; border: none;"> <tr> <td style="width: 33%; vertical-align: top;">           * Special categories of cited documents :            "A" document defining the general state of the art which is not considered to be of particular relevance            "E" earlier document but published on or after the international filing date            "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)            "O" document referring to an oral disclosure, use, exhibition or other means            "P" document published prior to the international filing date but later than the priority date claimed         </td> <td style="width: 33%; vertical-align: top;">           "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention            "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone            "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art            "&amp;" document member of the same patent family         </td> <td style="width: 33%;"></td> </tr> </table>			* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family	
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Date of the actual completion of the international search 2 June 1995 (02.06.95)		Date of mailing of the international search report 8 JUNE 1995 (08.06.95)			
Name and mailing address of the ISA/AU  AUSTRALIAN INDUSTRIAL PROPERTY ORGANISATION PO BOX 200 WODEN ACT 2606 AUSTRALIA  Facsimile No. 06 2853929		Authorized officer <i>Ash. Tean.</i> A. TESSEMA  Telephone No. (06) 283			

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate of the relevant passages	Relevant to Claim No.
X	Derwent Abstract Accession No. 91-335568/46, Class D13, JP, A, 3-224447 (HOWA SHOKUHIN KK) 3 October 1991 (03.10.91) See abstract	1-19
X	GB, A, 2 156 958 (GENERAL FOODS CORPORATION) 16 October 1985 (16.10.85) See page 1, col. 1, lines 104-108; & Claim 1	1-19
X	AU, B, 14364/88 (607204) (LEPRINO FOODS COMPANY) 13 October 1988 (13.10.88), Int Class A23C See page 5, line 36 - page 6, line 8; page 10, lines 3-18; & claims 1-12	1-19
X	WO, A, 93/021776 (UNILEVER PLC) 11 November 1993 (11.11.93) See page 2, lines 18-21; & claims	1-19
X	EP, A, 183595 (BONGRAIN SA), 4 June 1986 (04.06.86) See whole document	14
X	Derwent Abstract Accession No. 90-189416/25, Class D13, JP, A, 2-124061 (SNOW BRAND MILK PRODUCTS) 11 May 1990 (11.05.90) See abstract	14
A	Derwent Abstract Accession No. 91-027537/04, Class D13, JP, A, 2-299552 (LOTTE KK) 11 December 1990 (11.12.90) See abstract	1-19
A	US, A, 4 985 263 (NESTEC SA) 15 January 1991 (15.01.91) See whole document	1-19
A	EP, A, 560052 (SOCIETE DES PRODUITS NESTLE SA) 15 September 1993 (15.09.93) See whole document	1-19

**Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)**

This international search report has not established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
  
  
  
  
  
  
  
  
  
2. ☐ Claim Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
  
  
  
  
  
  
  
  
  
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
  
  
  
  
  
  
  
  
  
  
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

**Remark on Protest**

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

**PCT/NZ 95/00007**

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<b>END OF ANNEX</b>			